

The present invention provides an isolated archaeal and bacterial heme binding protein which reversibly binds oxygen with a low affinity. The heme binding protein may be utilized as a blood substitute. The invention also provides a method for controlled storage of oxygen by contacting a bacterial heme binding protein with oxygen allowing the protein to bind and store oxygen. The also provides methods to sense gaseous ligands using the heme binding protein. In other embodiments, the invention provides chimeric proteins having a heme-binding domain of an isolated heme binding archaeal bacterial protein and a heterologous signaling domain.